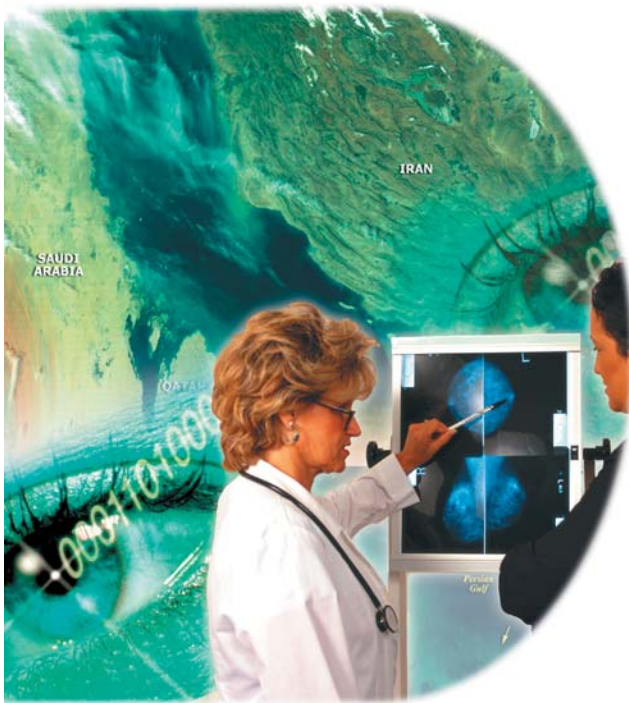## Technology Opportunity

Information Technology

Binarization of Noisy Images

The National Aeronautics and Space Administration (NASA) seeks to license its Binarization of Noisy Images technology, a fuzzy reasoning method, for use in commercial applications. Developed at the John F. Kennedy Space Center (KSC), this technology is a fuzzy reasoning adaptive thresholding (FRAT) system. Used for binarization of gray-scaled images, this technology is faster and more reliable than current high-reliability methods and is especially effective in noisy environments.

Potential Commercial Uses

Currently used to analyze launch debris and a crucial part if NASA's investigation into the Space Shuttle Columbia tragedy, FRAT has numerous potential commercial applications, including:

- Medical diagnostic imaging and Computer-Aided Detection (CAD) systems
- Remote sensing, including military and Earth resources
- Geophysical applications, including seismic, GPR, SAR, and magnetic anomaly
- Biometrics, including finger, facial, and iris scans
- Optical character recognition (OCR) and other scanning applications
- Security, surveillance, and baggage inspection systems
- Industrial machine vision and inspection systems

Benefits

- Superior performance in noisy, cluttered, or textured images

- More reliable and significantly faster than current fuzzy reasoning approaches

- More reliable than nonfuzzy reasoning approaches and comparable in speed

- Fully developed and proven effective in a critical NASA system

National Aeronautics and Space Administration
John F. Kennedy Space Center, FL

The Technology

NASA's fuzzy reasoning adaptive thresholding (FRAT) system is ideal for binarizing noisy, cluttered, or textured gray-scale images. Using a faster computational technique that improves on previous fuzzy entropy functions, FRAT is faster and more reliable than other current, highly reliable methods.

FRAT defines an image as an array of fuzzy singletons, corresponding to image pixels. With two classes, background and foreground, the membership function is built based on the average gray level of each class, which is computed using the gray-level histogram as average weight factor.

By using an unrestricted range and a straightforward traingular-type membership function, FRAT takes advantage of a simple linear function as the basis for its entropy measure. The entropy measure is then used as a cost function for the selection of the optimal image threshold.

FRAT is part of a critical NASA system used to identify and track foreign object debris (FOD) during Space Shuttle liftoffs. FRAT is also a key analysis tool used in the current investigation into the Space Shuttle Columbia tragedy.

FRAT features include:

- Exploitation of image pixel value histogram to avoid dealing with individual pixels
- Use of entropy measure as the criterion for selection of optimal threshold value
- Improvement on membership function to achieve more reliable and faster results

Options for Commercialization

This technology opportunity is part of the NASA Technology Transfer Program. The program seeks to stimulate development of commercial applications from NASA-developed technology. The technology type was designed, tested, and used at KSC. NASA seeks qualified companies to license and commercialize this technology.

Contact

If your company is interested in the Binarization of Noisy Images technology or if you desire additional information, please reference Case Number KSC-12490 and contact:

Kirsten Rieth
NASA Technology Applications Team
Telephone: (919) 967-4991
FAX: (919) 541-6221
krieth@rti.org

John Geikler
NASA Technology Applications Team
Telephone: (919) 941-8372
FAX: (919) 941-8399
johng@thesolutioncenter.com

Commercialization Checklist

✔ Patent Pending

   U.S. Patent

✔ Copyrighted

✔ Available to License

   Available for no-cost transfer

   Seeking industry partner for further codevelopment

KSC-12490/TOP10-83/06/03